STAT 385: Methods for Data Analysis and System Optimization

Term: Spring 2018; Course 23275 (Section 1)/23303 (Section 2)
Time: TTh 2:30 pm – 3:45 pm; Lab 6-8pm (Tues 23303 or Wed 23275)
Location: Class in Duncan Hall, DCH 1070; Labs in Symonds II

Instructors

Prof. John A. Dobelman
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Office Hours: By appointment.

Teaching Assistant (TA)

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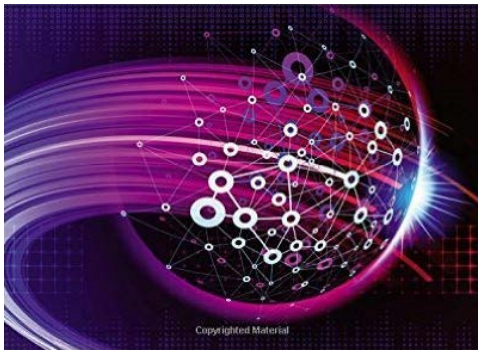
Office Hours: Labs, and Mon:30-3:30 pm

Course Website

http://dobelman.rice.edu (see courses)
We will also be using Canvas



Course Text

S. Christian Albright, Wayne L. Winston (2017), Business Analytics: Data Analysis & Decision Making, 6th Edition; *ISBN-10: 1305947541 | ISBN-13: 9781305947542 (**NOT** the 4th or 5th edition)*

Additional Recommended Text:
Bernard V. Liengme (2016), *A Guide to Microsoft Excel 2013 for Scientists and Engineers*
ISBN10: 0128028173 / ISBN13: 978-0-12-802817-9; $50 at AMZN

Course Description

The three general topic areas covered in this methodology oriented course are statistical methods including regression, sampling, and experimental design; simulation based methods in statistics, queuing and inventory problems; and an introduction to optimization methods. Excel will serve as the basic computing software.

Every.Sentence.Here.Is.Important.™

This document and the links referenced herein comprise the policies for this course. Please read everything fully and carefully.

Sponsored Message Regarding Student Responsibility:

The Committee on Examinations and Standing has asked that we reiterate the responsibilities of the student to comply with deadlines affecting their status and standing. Essentially this means that you need to be aware of the deadlines for which you alone are responsible (i.e., not your advisor, etc.). This data is maintained on http://registrar.rice.edu/calendars/.

Textbook

Students are expected to have purchased their required texts during the first week of class. If the text is available at the "Rice" bookstore, and the student elects to purchase the book elsewhere, and this elsewhere-obtained book is not in hand, THE STUDENT IS NONETHELESS RESPONSIBLE for all assignments and readings. Usually provision cannot be made for down-

edition situations; advance coordination with the instructor/TA must be made. It is the student's responsibility to comply with all deadlines if they choose to use a down- or up-edition text. Additionally, Rice University is generally not able to provide copies of these texts for your use.

Grading

Grading for this course will consist of Labs and homework exercises/cases from the text (20%), concept quizzes (55%), a Final Team Project (20%), and Class Participation (5%)/Team Evaluation (5%, consisting of self-, peer- and instructor evaluations). If Team Projects are waived, the grade breakdown will be 20% Homework/Assignments, 75% Concept Quizzes, and 5% Class Participation. The final project is to be completed as a team project. It has been determined that about 40% of the class will receive a grade equal to or higher than an "A-," with about a proportion of 7% receiving an "A+."

Assignment Submission and Late policy

All assignments must be submitted in class on the date due as hard copy, with a soft copy submitted on Canvas as well. Both hard and soft copies of the assignments are required in order to receive credit for the assignment, neither can be late. There are NO EXCEPTIONS. The instructors/TA will not be able to print out e-mailed or online-only assignment submissions. Please see the detailed submission standards for complete details.

NOTE: It is expected and encouraged that students will use whatever software best helps them complete the assignments. Very little work will require hand-calculation or table lookup, although the student should know how to do this in case of shipwreck.

Laboratory

Occasionally, dedicated Lab projects will be assigned. Weekly lab time is set aside for you to work on and receive help on homework and team projects. Attendance is optional, but if you miss the lab problem-solving session, the TA will not be able provide the time to you. You should therefore begin work on the assignment prior to the lab session.

Quizzes

There will be closed book quizzes given during the class period. These quizzes will cover concepts discussed in class. They will be announced in class and on Canvas.

Final Team Project

A final project may be assigned which will be completed in groups/teams. Sometimes a quantitative case is provided, other times the project may be based on the various case studies included in your textbook. In the latter case, you and your team will choose a case to solve. You may pick your own team members, but the size of each team will be limited to an appropriate number (no more than three).

Extra Credit

From time to time, extra credit opportunities will be provided. These will be assigned in class, and generally NOT posted on Canvas.

Professional Standards

All assignments, with exception of handwritten math proofs and things of that nature, must be prepared nicely (like this syllabus, *más o menos*.) This means you need to organize it neatly with appropriate layout, graphics, citations, etc. Unnecessary printouts of numbers are not acceptable,

nor are meaningless digits of precision, etc. The font should be large enough for management to easily read (no less than 10-point font, preferably 12).

For group projects, you should include a cover page indicating the class, assignment, date submitted, and name of student or group members and group number. In the real world, if your management/customers or clients cannot read the report, or if it is filled with superfluous information, they will just return it to you with a request to resubmit. If you are unlucky, they will just pass you over for someone who does these things better.

Originality

Although some assignments are not "pledged", keep in mind that plagiarism is a serious problem, and is especially problematic for the student or researcher. Plagiarism will be treated, for pledged assignments, in accordance with the honor code provisions; and for non-pledged assignments, your paper will be returned for a rewrite with the automatic deduction of one letter grade. By plagiarism we mean "quoting, paraphrasing, or otherwise using another's words or ideas as one's own without properly crediting the source." Unfortunately, with the prevalence of internet sources, it is sometimes easy to inadvertently commit plagiarism. In order to avoid this problem, you should consult this white paper http://www.stat.rice.edu/~dobelman/courses/Plagarism.Hewitt.2016.pdf and http://futureowls.rice.edu/futureowls/Honor_Code.asp.

Attendance

Students are expected to attend class. Much material is presented in class which might not otherwise be in texts, notes, etc. Attendance will be reflected in the Class Participation portion of the course grade. Although we plan on keeping the course website up to date, if a student misses a class, then s/he is responsible for keeping up with the course material and finding out if any exams, quizzes, or homeworks have been assigned or scheduled. Similarly, important due date changes might sometimes be made in class to your benefit which might not be immediately posted on Canvas.

Laptops and Other Portable Electronic Devices (PED)

Unless so requested by the instructors, please do not use these devices during class, they are a distraction to other students. Prohibited devices include laptops, earbuds, gaming devices, mp3/music/media players, cell/smart-phones, PDA's, Kindle/e-book readers, tablet computers/readers, Apple watch, i* devices, multi-purpose wrist communicators, cameras, GPS/GIS devices, Google glasses, etc. Hearing aids are acceptable to use in accordance with the last item (disabilities) and procedures herein. From time to time the instructors may ask a student to look something up, but in most cases, this is not necessary. If the student requests, such devices may be permitted, if the purpose is clearly articulated in advance. The student will be asked to put away their PED's if they are taken out in class; upon the second request, the student will be dismissed from class.

Software

The software for the course is primarily Microsoft Excel and the Palisades DecisionTools Suite Industrial, Textbook Edition. It is available for download at: http://www.palisade.com/bookdownloads/albrightwinstonzappe/ Please note that these two versions are for Office 2016/2013/2010/2007/2003 and later.

It is impossible to perform statistical/quantitative data analysis without some sort of computer software, and it is expected that the student will become proficient with one or more statistical software packages. The most widely used data analysis software in the real world today is

Microsoft Excel, and its capabilities are impressive. However, more specialized software is sometimes needed, such as Matlab, R/S-Plus, SAS, Python, SQL, Resampling Stats, SPSS, Stata, StatTools, StatExact, Lisrel, @Risk, Maple, Mathematica, C-Plex, etc. Of these, R and Python have become the choice of many because of their relative ease of use and low cost (FREE!) Download information for some of these packages is available on the course website(s).

One can also program most statistical procedures in a "high-level" programming language such as Java, C/C#/C++, Fortran, VB, etc., along with specialized add-in routine libraries, but these require a lot of work to code and debug. Additionally, you will find that most corporate employers will not be paying for the nice software that is available for you here on campus. Consequently, to enhance your value to your future employer, we suggest that you become proficient in Excel, R/Python and SQL/SAS. Note that a good word processor will also be required in order to prepare reports and presentations; Microsoft Word, OpenSource, LaTeX, etc., are candidates for use in preparing these documents, although use of LaTeX in the business world is sparse.

Course Content

We plan to cover most of this material. Note that Parts I-III have already been covered to some good extent in the prerequisites for this course, i.e. STAT 280 or STAT 305 or STAT 310/ECON 307. If you do not remember these concepts, please review the material prior to coming to class since we cannot re-cover all this material in class. Topics/chapters include

Part 0.1: INTRODUCTION

1. Introduction. An Overview of the Book. The Methods. The Software. A Sampling of Examples. Modeling and Models.

Part I: GETTING, DESCRIBING, AND SUMMARIZING DATA.

2. Describing the Distribution of a Single Variable.
Basic Concepts. Descriptive Measures for Categorical Variables. Descriptive Measures for Numerical Variables. Time Series Data. Outliers and Missing Values. Excel Tables for Filtering, Sorting, and Summarizing.

3. Finding Relationships Among Variables.
Introduction. Relationships Among Categorical Variables. Relationships Among Categorical Variables and a Numerical Variable. Relationships Among Numerical Variables. Pivot Tables. An Extended Example.

Part II: PROBABILITY, UNCERTAINTY, AND DECISION MAKING.

4. Probability and Probability Distributions.
Introduction. Probability Essentials. Distribution of a Single Random Variable. An Introduction to Simulation. Distribution of Two Random Variables: Scenario Approach. Distribution of Two Random Variables: Joint Probability Approach. Independent Random Variables. Weighted Sums of Random Variables.

5. Normal, Binomial, Poisson, and Exponential Distributions.
Introduction. The Normal Distribution. Applications of the Normal Distribution. The Binomial Distribution. Applications of the Binomial Distribution. The Poisson and Exponential Distributions. Fitting a Probability Distribution to Data: BestFit.

6. Decision Making Under Uncertainty.
Introduction. Elements of a Decision Analysis. The PrecisionTree Add-In. Bayes' Rule. Multistage Decision Problems. Incorporating Attitudes Toward Risk.

Part III: STATISTICAL INFERENCE.

7. Sampling and Sampling Distributions.
Introduction. Sampling Terminology. Methods for Selecting Random Samples. An Introduction to Estimation.

8. Confidence Interval Estimation.
Introduction. Sampling Distributions. Confidence Interval for a Mean. Confidence Interval for a Total. Confidence Interval for a Proportion. Confidence Interval for a Standard Deviation. Confidence Interval for the Difference Between Means. Confidence Interval for the Difference Between Proportions Controlling Confidence Interval Length.

9. Hypothesis Testing.
Introduction. Concepts in Hypothesis Testing. Hypothesis Tests for a Population Mean. Hypothesis Tests for Other Parameters. Tests for Normality. Chi-Square Test for Independence. One-Way ANOVA.

Part IV: REGRESSION, FORECASTING, AND TIME SERIES.
10. Regression Analysis: Estimating Relationships.
Introduction. Scatterplots: Graphing Relationships. Correlations: Indicators of Linear Relationships Simple Linear Regression. Multiple Regression. Modeling Possibilities. Validation of the Fit.

11. Regression Analysis: Statistical Inference Introduction. The Statistical Model. Inferences About the Regression Coefficients. Multicollinearity. Include/Exclude Decisions. Stepwise Regression.The Partial F Test. Outliers. Violations of Regression Assumptions. Prediction.

12. Time Series Analysis and Forecasting.
Introduction. Forecasting Methods: An Overview. Testing for Randomness. Regression-Based Trend Models. The Random Walk Model. Autoregression Models. Moving Averages. Exponential Smoothing. Seasonal Models. Winters' Exponential Smoothing Model.

Part V: DECISION MODELING.
13. Introduction to Optimization Modeling.
Introduction. Introduction to Optimization. A Two-Variable Model. Sensitivity Analysis Properties of Linear Models. Infeasibility and Unboundedness. A Product Mix Model. A Multiperiod Production Model. A Comparison of Algebraic and Spreadsheet Models. A Decision Support System.

14. Optimization Modeling: Applications.
Introduction. Workforce Scheduling Models. Blending Models. Logistics Models. Aggregate Planning Models. Financial Models. Integer Programming Models. Nonlinear Models.

15.Introduction to Simulation Modeling.
Introduction. Real Applications of Simulation. Probability Distributions for Input Variables. Simulation with Built-In Excel Tools. Introduction to @RISK. The Effects of Input Distributions on Results.

16.Simulation Models.
Introduction. Operations Models. Financial Models. Marketing Models. Simulating Games of Chance.

Part 0.2: DECISION MODELING (CH 17, Online Resource).
17 Getting the Right Data.
Introduction. Sources of Data. Excel Tables for Filtering, Sorting, and Summarizing. Complex Queries with the Advanced Filter. Importing External Data from Access. Creating Pivot Tables from External Data. Web Queries. Other Data Sources on the Web. Cleansing the Data.

Rice Honor Code

Before enrolling in this course, you must understand and agree to abide by the Honor System in place at Rice University which protects the academic integrity of all coursework. All students (including graduate students) at Rice are bound by the Rice Honor Code. New students should familiarize themselves with the Honor Code before starting classes. The Honor Code is a unique feature at Rice, one that is valued highly, and is of profound importance. Honor Code violations are very serious, and can lead to dismissal from the University. See http://honor.rice.edu

Examinations, if held, are conducted under pledged conditions. Proper recitation and use of the Honor Pledge on examinations will normally be worth 5% of the exam grade.

Homework and group assignments/projects may be worked on with other class members but each student must submit their own work for credit. Homeworks should be submitted by each person, but you should indicate with whom you worked when applicable. No direct copying is allowed. Group projects and assignments may be submitted by the group.

Religious Holidays

If you wish to be excused from class on any of these days which do not coincide with University holidays already on the official academic calendar, you must notify the instructor in writing no later than the **second week of class**. Absence from classes or examinations for religious reasons does not relieve students from responsibility for any part of the course work required during the period of absence

Disabilities

Any student with a documented disability wishing academic adjustments or accommodation is required to speak with the instructor about it during the first two weeks of class. All discussions will remain confidential. Additionally, you must make sure this documentation is on file with Disability Support Services (Allen Center, Room 111 | adarice@rice.edu | x5841) in order to register your disability and to determine the accommodations you need. The instructor cannot be make accommodation without the appropriate letter from Rice DSS. Additional program and documentation requirements and responsibilities are spelled out at http://dss.rice.edu/.

Changes to Syllabus

Changes to this syllabus may be published from time to time, with notice and explanation given in class and via Canvas (if used).

Rev: 12/31/2017